

Additions to the Cone Shell Faunas of Australia and Aruba (Conidae, Conilithidae)

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ABSTRACT Two new cone shells, one in the family Conidae and one in the family Conilithidae, are described from eastern Australia and Aruba. The new conid, *Tesselliconus devorsinei* n. sp., was dredged from 30 m depth off southern Queensland, Australia, and represents the newest member of a poorly-known deeper Neritic Zone *Tesselliconus* species complex that includes *T. sandwichensis* and *T. athenae* from Hawaii, *T. kashiwajimensis* from southern Japan, and *T. edaphus* from the Panamic Province. The new conilithid, *Jaspidiconus vantwoudti* n. sp., was found to be endemic to the Dutch Antilles island of Aruba, where it occurs in shallow subtidal rocky areas in the surf and surge zone.

KEY WORDS

Cone shells, Conidae, Conilithidae, *Tesselliconus*, *Jaspidiconus*, Queensland, Australia, Aruba, *Tesselliconus devorsinei*, *Jaspidiconus vantwoudti*.

INTRODUCTION

The peripheral edges of marine molluscan provinces and subprovinces have long been known to be areas where speciation has accelerated due to genetic isolation and exposure to marginal environmental conditions (Briggs, 1974, 1995; Petuch, 1982; Petuch, 2013; Valentine, 1973; Vermeij, 1978). Due to restricted gene flow and differences in ecological conditions, these peripheral areas typically produce large numbers of endemic species, often unique to single islands or small geographical areas. Two classic examples of the peripheral areas of provinces and subprovinces include the extreme southernmost coast of Queensland, Australia and the island of Aruba in the southern Caribbean Sea. The deeper water

areas offshore of Cape Moreton and Moreton Island, Queensland are known to house a large number of endemic marine gastropods, particularly in the families Volutidae and Conidae. Due to cooler water conditions produced by upwellings, this geographically-small area represents the extreme southernmost edge of the Solanderian Province of the Australian Region and contains oceanographic conditions that are barely marginal for most of its tropical faunal components. Similarly, Aruba represents the westernmost edge of the Grenadian Subprovince of the Caribbean Province and is subject to upwelling-driven cooler water conditions. Like the Cape Moreton area, the coastline of Aruba is known to contain numerous examples of large endemic gastropods.

Intensive field work, incorporating both diving and dredging, has recently been undertaken by several inspired amateur naturalists in the peripheral areas of both southern Queensland and Aruba. These efforts have led to the discovery of two new endemic cone shells, both of which represent peripheral isolate sibling species that belong to wide-ranging species complexes. These cone shells, including a new Australian species in the genus *Tesselliconus* (family Conidae) and a new Aruban species in the genus *Jaspidiconus* (family Conilithidae), are described in the following sections. Their discovery demonstrates the importance of biogeographical peripheral areas as centers of speciation and evolution in the world's oceans.

SYSTEMATICS

Class Gastropoda

Subclass Orthogastropoda

Superorder Caenogastropoda

Order Sorbeoconcha

Infraorder Neogastropoda

Superfamily Conoidea

Family Conidae

Subfamily Puncticulinae

Genus *Tesselliconus* da Motta, 1991

Tesselliconus devorsinei Petuch, Berschauer,
and Poremski, new species
(Figure 1A-C)

Description: Shell of average size for genus, stocky, subturbinate, broad across shoulder; shell with distinctly concave sides, with widest area just below shoulder angle; shoulder angled but slightly rounded; spire elevated, with early whorls raised above plane of spire; early whorls broadly pyramidal in shape, distinctly truncated, heavily ornamented with strong spiral cords and small low rounded beads; spire whorls ornamented with 3 large spiral cords, with cord

along suture being twice as thick as other two cords; body whorl shiny, ornamented with 22-24 incised spiral grooves which become stronger and better developed toward anterior end; spiral grooves vary in development, with some specimens having heavily-sculptured shells and others being smoother and more polished; anterior third of body whorl heavily sculptured with numerous deeply-incised spiral sulci, often arranged in pairs; largest and most deeply-incised sulci contain fine, closely-packed tiny pits; shell color white or pale violet-white, overlaid with 3 wide bands of pale orange-tan, one around shoulder, one posterior of mid-body line, and one anterior of mid-body line; wide color bands with variable number of rows of large, rectangular orange-tan spots; mid-body area with wide white band containing two rows of widely-spaced, large, rectangular orange spots; anterior tip bright violet-purple; spire white, marked with large, evenly-spaced, elongated dark orange-tan flammules; spire flammules extend onto edge of shoulder, producing checkered pattern; spire flammules of body whorl and previous whorls fuse to form distinct radiating pattern; aperture proportionally narrow, arcuate, following curvature of body whorl outline; interior of aperture colored pale yellow-cream; protoconch white, proportionally large, mammilate, composed of two rounded whorls; periostracum thin, smooth, translucent.

Type Material: HOLOTYPE - length 29 mm, width 17 mm (Figure 1A, B), QM M080845, molluscan collection of the Biodiversity Section, Queensland Museum, Brisbane, Queensland, Australia. Other material includes a 30 mm specimen (David Berschauer collection, Figure 1C, D), a 34 mm specimen (E.J. Petuch collection), and a 37 mm specimen (Remy Devorsine collection), all from the same locality and depth as the holotype.

Type Locality: Dredged from 15 fathoms (27.5 m) depth, due east of Mooloolaba, Queensland State, Australia.

Range: At present, known only from the southern coast of Queensland, off Mooloolaba, but may range to Cape Moreton and Moreton Bay and possibly extreme northernmost New South Wales.

Ecology: The new species occurs within the Neritic Zone, on coral rubble and carbonate sand substrates, in depths of around 30 m.

Etymology: Named for Remy Devorsine of Avoca Beach, New South Wales, Australia, who dredged the new species from off Mooloolaba.

Discussion: Of the seven known species in the genus *Tesselliconus*, *T. devorsinei* is most similar to the eastern Indian Ocean - southwestern Pacific *T. suturatus* (Reeve, 1844) (Figure 2A, B), particularly in having a stocky, barrel-shaped shell profile. The new Australian species differs from its widespread congener, however, in being a much more sculptured shell, with numerous deeply-incised spiral cords and threads, in being a much more colorful shell, having rows of orange-tan checkers and rectangular dots on a pale violet base color, and in having a completely different sculpture pattern on the spire whorls, with three large spiral cords and numerous strong coronations and rounded beads and in having a distinctive raised, truncated pyramid shape to the early whorls (Figures 1B, D). The early whorls of *T. suturatus*, on the other hand, are much smoother, having only two large raised spiral cords and are only slightly exerted, forming a small acutely-angled pyramidal structure that is devoid of coronations.

With its checkered color pattern, *T. devorsinei* is also similar to *T. tessulatus* (Born, 1778) (type of the genus; Figure 2C), but differs in being a stockier, less elongated, and more inflated shell, and in being a more heavily sculptured shell, with incised spiral sulci on the body whorl and in having a truncated pyramidal spire that is ornamented with large spiral cords and rounded coronations. The highly ornate spire whorls of the new species are also reminiscent of another deep water *Tesselliconus* species, *T. athenae* (Filmer, 2011) from 105 fathoms (192 m) depth off Keehi Lagoon, Oahu, Hawaii (Figure 2D). *Tesselliconus devorsinei* differs from this deep water Hawaiian endemic in having a lower, less elevated spire, and in having a distinct truncated pyramid shape to the early spire whorls. The new species is also similar in appearance to another Hawaiian endemic *Tesselliconus*, *T. sandwichensis* (Walls, 1978) (Figures 2E, F), but differs in having a stockier, less elongated shell, in having deeply-incised spiral cords on the body whorl, and in having a different spire whorl configuration, with a truncated pyramid shape and heavy sculpture composed of large spiral cords and low knobs and coronations.

With the exception of the widespread, shallow water *Tesselliconus suturatus* and *T. tessulatus*, all the other known congeneric species are found in deeper, offshore areas along the outer edges of the biogeographical limits of the genus. These peripheral endemic species may represent disparate populations of *Tesselliconus* which became isolated on the fringes of the Indo - Pacific Region during the Pleistocene. Since that time, these peripheral isolates have evolved into a complex of sibling species, with each being restricted to a limited geographical area. This peripheral isolate sibling species complex includes:

- *Tesselliconus athenae* (Filmer, 2011) - endemic to deep water areas off Oahu, Hawaii
- *Tesselliconus devorsinei* Petuch, Berschauer, and Poremski, n. sp. - endemic to deeper water off southernmost Queensland, Australia
- *Tesselliconus edaphus* (Dall, 1910) - restricted to the Panamic Province, from the Gulf of California to Panama and Cocos Island
- *Tesselliconus kashiwajimensis* (Shikama, 1971) - restricted to southern Japan, the Ryukyu Islands
- *Tesselliconus sandwichensis* (Walls, 1978) - endemic to the Hawaiian Islands

Future research into the deep water and deep Neritic Zone cone faunas of other fringe areas of the Indo-Pacific, such as northwestern Australia and the Marquesas and Tuamotu Islands of eastern Polynesia, may yield other, previously-unknown, members of this species complex.

Family Conilithidae

Subfamily Conilithinae

Genus *Jaspidiconus* Petuch, 2004

Jaspidiconus vantwoudti Petuch, Berschauer, and Poremski, new species (Figure 3A-F; Figure 4 C, D)

Description: Shell small for genus, averaging only around 14 mm, stocky and inflated, broad across shoulder, with high, broadly pyramidal spire and rounded, convex sides; spire with distinctly sloping whorls; shoulder angled, bordered by small, rounded carina; body whorl shiny, ornamented with 20-24 faint, slightly-incised, evenly-spaced spiral sulci; sulci become stronger and better-developed toward anterior end; spire whorls smooth, ornamented with very numerous, closely-packed, radiating curved threads, which correspond to growth increments (Figure 3C, D); aperture proportionally wide and flaring, becoming wider toward anterior end;

base shell color bright pink, overlaid with variable amounts of darker pink or purplish-pink amorphous flammules; spire whorls marked with prominent large, widely-spaced, dark pink or pinkish-purple amorphous flammules; interior of aperture pink, becoming darker farther within interior; protoconch proportionally very large and prominent, shiny, composed of 2 rounded, domed whorls; protoconch color deep purple-pink; periostracum very thin, smooth, transparent.

Type Material: HOLOTYPE - length 12.4 mm, width 6.5 mm (Figure 3A, C), LACM 3432, type collection of the Department of Malacology, Los Angeles County Museum of Natural History, Los Angeles, California. Other material includes a 14 mm specimen in the research collection of E.J. Petuch (Figure 3B, D), a 12.4 mm specimen in the Berschauer collection, and a 13.4 mm specimen in the Poremski collection, all from the same locality and depth as the holotype.

Type Locality: Collected in 2 m depth, on exposed hard, rocky surface in high current and surge, near Arashi Beach, Noord District, Aruba.

Range: Known only from Aruba, to which the new species appears to be endemic.

Ecology: The new species prefers shallow water exposed rocky platforms, in areas with strong currents and wave surge.

Etymology: The taxon honors Alain Van't Woudt of Den Hoorn, The Netherlands, who collected the type lot on Aruba.

Discussion: The Grenadian Subprovince of the Caribbean Molluscan Province, which extends from Aruba to Anguilla, and encompasses all the island chains off the Venezuelan coast and the Lesser Antilles, is now known to house

three pink or pinkish-orange, similar-appearing endemic *Jaspidiconus* species: *J. berschaueri* from the northern Lesser Antilles (Windward Islands), particularly Sint Maarten; *J. arawak* from the southern Lesser Antilles (Leeward Islands), especially the Grenadines; and *J. vantwoudti* from Aruba (Netherlands Antilles). The new Aruban endemic described here is most similar to *J. arawak* (Figure 4A), but differs in being a smaller and stubbier shell with a smoother and shinier body whorl that lacks any pustules or beads, in having a more rounded and less developed shoulder carina, in having large, prominent dark pink or pinkish-purple patches on the spire whorls, in lacking the rows of tiny tan dots around the shoulder carina and sutures of the spire whorls, and in having a proportionally much larger and more domed protoconch. The new Aruban species differs from the Windward Islands *J. berschaueri* (Figure 4B) in being a smaller, stockier, and much less elongated shell with a proportionally lower and less elevated spire, in being a much smoother and less sculptured shell that is devoid of any prominent beads or pustules, in lacking large tan dots along the edge of the shoulder carina, and in having a proportionally much large protoconch.

These three pink cones form a distinctive species complex that is restricted to the Grenadian Subprovince. Throughout the area extending from Tobago to Los Roques Atoll, members of this species complex often occur together with the much larger, variably-colored, and heavily-sculptured *J. jaspideus* (Gmelin, 1791) (see Petuch, 2013: 133). Unlike the restricted ranges of the three Grenadian Subprovince endemics, the type of the genus *Jaspidiconus*, is a widespread species which ranges from Tobago all the way to Panama and may co-occur with the three pink species in certain localities. Of these four southern Caribbean *Jaspidiconus* species, the new

Aruban endemic also has one of the most unusual habitat preferences of any of the known species of *Jaspidiconus*. Most of the members of this group of small cones prefer sandy environments, preferably clean carbonate sand or muddy quartz sand, along the entire western Atlantic, from Cape Hatteras, North Carolina to Santa Catarina State, Brazil. *Jaspidiconus vantwoudti* is the only species of its genus known to prefer open, exposed rocky platforms in shallow, high surge and strong current areas. The closely-related and similar-appearing *J. arawak* and *J. berschaueri* both prefer quiet water, clean carbonate sand areas near living coral reefs and coral rubble, as does the sympatric and widespread *J. jaspideus*. Because of its bright pink shell color, *Jaspidiconus vantwoudti* has often been referred to the taxon “*Jaspidiconus fluviamaris* Petuch and Sargent, 2011” by other workers and collectors. That species, however, is restricted to the Floridian Subprovince of the Carolinian Molluscan Province and ranges only from the Dry Tortugas island chain of the southeastern Gulf of Mexico, through the Florida Keys, and northward to Palm Beach County, Florida. Although having the same intense pink and pinkish-purple color of the new Aruban endemic, *J. fluviamaris* differs in being a larger and more elongated shell with a distinctly cylindrical shape and much straighter sides, and in having distinctly stepped, scalariform spire whorls that differ greatly from the sloping spire whorls of *J. vantwoudti*.

The new *Jaspidiconus* is the sixth-known endemic cone shell to be found on Aruba and its discovery underscores the uniqueness of the Aruban molluscan fauna. This Aruban endemic cone fauna is now known to include the conids *Arubaconus hieroglyphus* (Duclos, 1833), *Tenorioconus curassaviensis* (Hwass, 1792), *Tenorioconus monicae* Petuch and Berschauer, 2015, and *Tenorioconus rosi* Petuch and

Berschauer, 2015, and the conilithids *Perplexiconus wendrosi* (Tenorio and Afonso, 2013) and *Jaspidiconus vantwoudti* (see Petuch, 2013: 134-137 and Petuch and Berschauer, 2015: 195-205 for a review of the endemic marine gastropods of Aruba).

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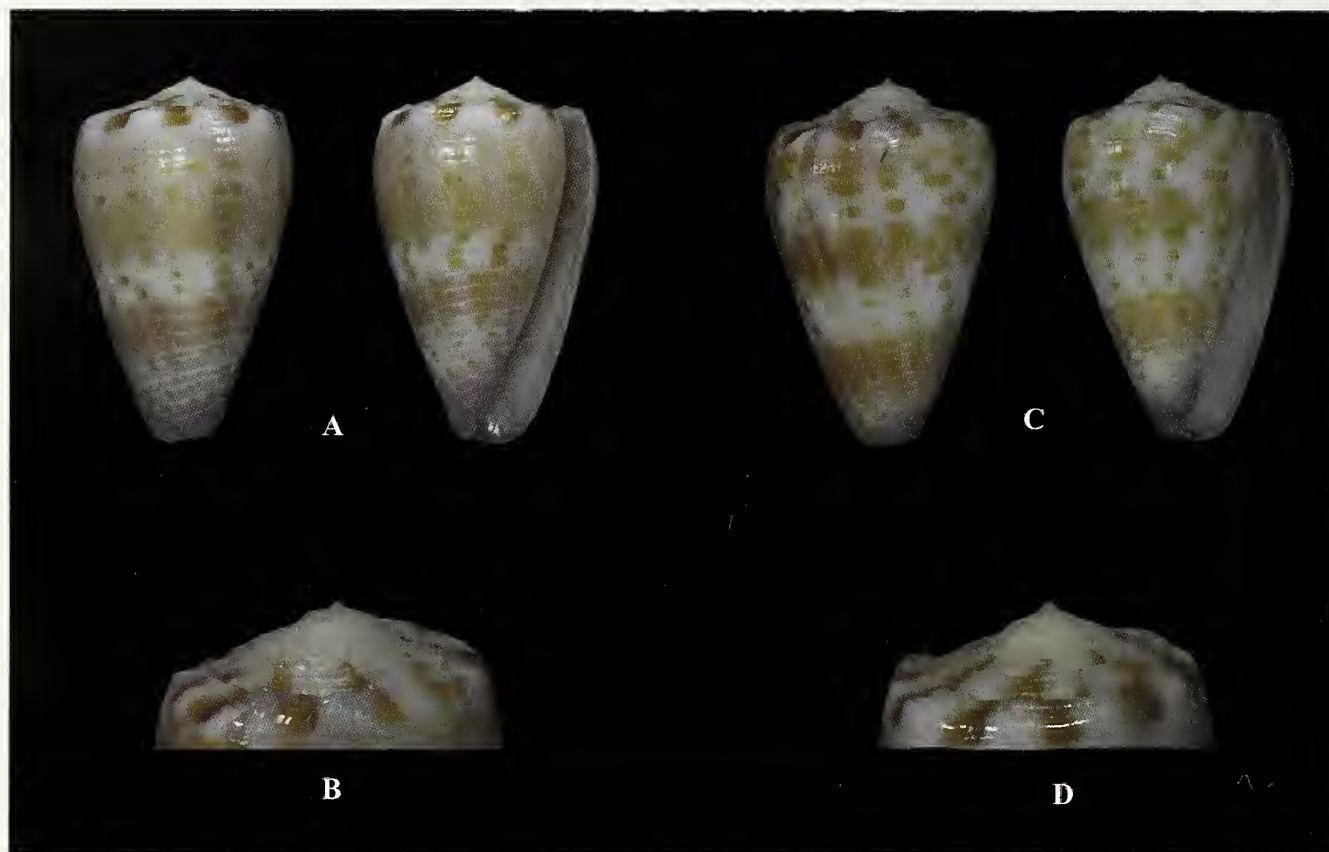


Figure 1. *Tesselliconus devorsinei* new species. **A**= Holotype (QM M080845, molluscan collection of the Biodiversity Section, Queensland Museum, Brisbane, Queensland, Australia), length 29 mm; **B**= close-up view of the spire of the holotype, showing the distinctive truncated pyramid shape and beaded sculpture of the early whorls; **C**= specimen with wide bands of orange-tan rectangular spots, length 30 mm, Berschauer Collection; **D**= close-up view of the spire of the 30 mm specimen, showing the distinctive truncated pyramid spire. Both specimens were dredged from 15 fathoms (27.5 m) depth east of Mooloolaba, Queensland, Australia.

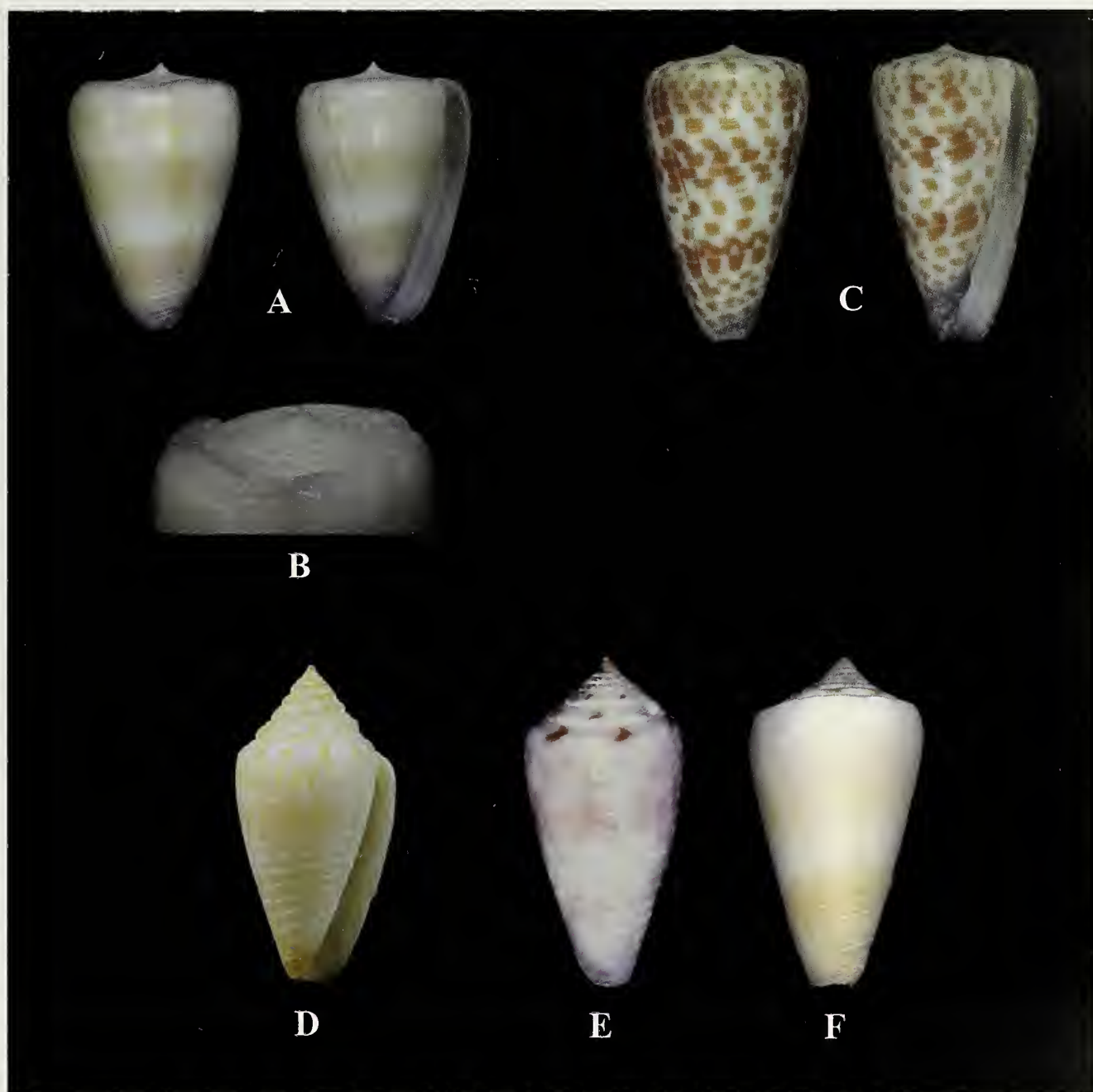


Figure 2. *Tesselliconus* species, for comparison with *T. devorsinei*. **A**= *Tesselliconus suturatus* (Reeve, 1844), length 43 mm, 3 m depth in clean coral sand, off Fitzroy Reef, Great Barrier Reef, Queensland, Australia; **B**= close-up view of the spire of *T. suturatus*, showing the narrow, acutely-angled early whorls which lack the beaded sculpture seen on *T. devorsinei*; **C**= *Tesselliconus tessulatus* (Born, 1778), length 49 mm, 2 m depth in clean coral sand, Sykes Reef, Swain Group, Great Barrier Reef, Queensland, Australia; **D**= *Tesselliconus athenae* (Filmer, 2011), holotype, length 22.6 mm, dredged from 105 fathoms (192 m) depth off Keehi Lagoon, Oahu, Hawaii; **E**= *Tesselliconus sandwichensis* (Walls, 1978), holotype, length 14.4 mm, in sand on reef off Pokai Bay, Oahu, Hawaii; **F**= *Tesselliconus sandwichensis* (Walls, 1978), length 35 mm, on deep reefs off Oahu, Hawaii; photo courtesy of Paul Kersten.

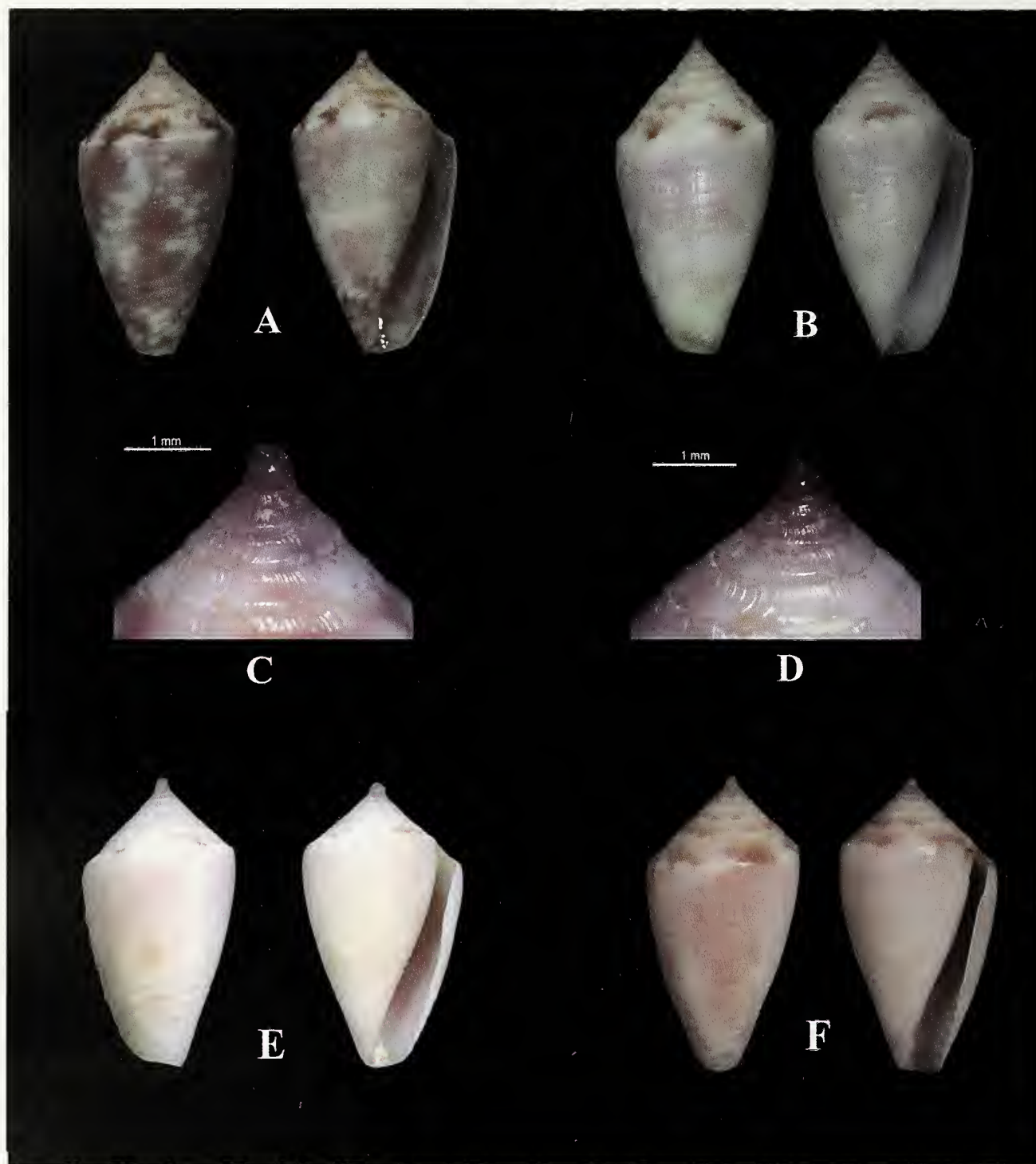


Figure 3. *Jaspidicomus vantwoudti* new species. **A**= Holotype (LACM 3422, type collection of the Department of Malacology, Los Angeles County Museum of Natural History, Los Angeles, California), length 12.5 mm; **B**= length 14 mm. Petuch Collection; **C**= close-up of the spire of the holotype, showing details of the proportionally-large, bulbous protoconch; **D**= close-up of the spire of the 14 mm specimen in the Petuch Collection, showing details of the proportionally-large protoconch; **E**= specimen length 12.6 mm; **F**= specimen length 11.8 mm. All specimens collected on exposed rocky platforms in 1-2 m depths, in areas of strong currents and wave surge, near Arashi Beach, Aruba.



Figure 4. *Jaspidiconus* species from the Grenadian Subprovince of the Caribbean Molluscan Province. **A=** *Jaspidiconus arawak* Petuch and Myers, 2014, holotype, length 15 mm, from 3 m depth, in carbonate sand near coral reef, off Petit Martinique, Grenadines; **B=** *Jaspidiconus berschaueri* Petuch and Myers, 2014, length, holotype, length 18 mm, found in coral rubble in beach drift, Sint Maarten Island, Lesser Antilles; **C=** *Jaspidiconus vantwoudti* Petuch, Berschauer, and Poremski, new species, length 12.8 mm, near Arashi Beach, Aruba, for comparison with *J. arawak* and *J. berschaueri*; **D=** *Jaspidiconus vantwoudti* Petuch, Berschauer, and Poremski, new species, length 13.4 mm, near Arashi Beach, Aruba, for comparison with *J. arawak* and *J. berschaueri*.

Note: Club members, mark your calendars! The November Auction is scheduled for Saturday, November 14, 2015, beginning at 1:00 p.m. in the conference room at the Holiday Inn Express located at 751 Raintree Drive, Carlsbad. Food and beverages will be made available by the Club. An auction list will be e-mailed to all members prior to the event.

